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INFLUENCE OF DIFFERENT SEED RATE AND NUTRIENT MEDIA ON GROWTH ATTRIBUTERS OF TRAY NURSERY RICE SEEDLINGS FOR MACHINE TRANSPLANTING

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ABSTRACT

A experiment was conducted at central farm of Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai during the month of October, 2015 to study the effect of seed rate and tray media for production of good quality seedlings for machine transplanting. Treatment comprised in main four level of seed rate viz., 100, 80, 60, and 40 gram tray^{-1} and nine level of media viz., M_1–Native soil, M_2 - Native soil + FYM (4:1), M_3 - Native soil + VC (4:1), M_4 - Native soil + Coir pith (4:1), M_5- Native soil + Sand (4:1), M_6 - Native soil + FYM + VC (3:1:1), M_7 - Native soil + Coir pith + VC (3:1:1), M_8- Native soil + FYM + Rice husk (3:1:1), M_9- Native soil + FYM+ VC + Rice husk (3:1:0.5:0.5). The maximum seedlings growth attributes viz., seedling height, root length, dry matter product (DMP) and SPAD values were noticed under combination of 40 g seed rate tray^{-1} with Native soil + Coir pith + VC than that of other treatment combinations. Hence, moderate seed rate of 80 g tray^{-1} sowing in the media contain native soil + Coir pith + VC at 3:1:1 ratio can be recommend in production of sturdy rice seedling for machine transplanting.

KEYWORDS: Seed Rate, Nursery Media, Growth Characters & Machine Transplanting

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Original Article

INTRODUCTION

Across South Asia, labour scarcity is a major problem and there is a need to explore establishment methods for rice that require less labour but still allow the crop to be transplanted on time. The use of a mechanical transplanter is one alternative to address this issue. In Tamil Nadu, which is largely a rainfed and lowland rice growing environment, the timeliness of transplanting can be further improved by the replacement of transplanting by a inclusion of mechanized transplanting. Timely transplanting of rice is based on the premise cheap and readily available labour. In Tamil Nadu labour scarcity is no longer projection, but rather a hard felt reality. Machine transplanting can be good alternative to address these issues for sustainable rice production in periyar vaiagi command area of Tamil Nadu.

In the machine transplanting were noticed absence of production of good quality seedlings in terms of density per tray (seed rate) and growing media. The tray soil management need to ensure optimum nursery medium and supply the nutrient to the seedlings. It influences the roots penetrating the underlying soil and creating a dense mat. This type of nursery is a prerequisite for machine transplanting. The mat can be get into desired

shapes and sizes to fit into the trays of the transplanter and it has evaluated different age of seedling. Hence, the present study was aimed to investigate the effect of seed rate and nursery growing media on growth characters of seedling for machine transplanting.

MATERIAL AND METHODS

Field experiments was conducted at central farm of Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai during the month of October, 2015. The experiment was laid out in a Split Plot Design with three replications. The main plot consisted of four level of seed rate *viz.*, (S_1-100 g seed tray^{-1}, S_2-80 g seed tray^{-1}, S_3-60 g seed tray^{-1} and S_4-40 g seed tray^{-1}) and subplot comprised of nine level of media *viz.*, M_1–Native soil, M_2 - Native soil + Farm yard manure (FYM) (4:1), M_3 - Native soil + Vermicompost (VC) (4:1), M_4 – Native soil + Coir pith (4:1), M_5-Native soil + Sand (4:1), M_6 - Native soil + FYM + VC (3:1:1), M_7 - Native soil + Coir pith + VC (3:1:1), M_8- Native soil + FYM + Rice husk (3:1:1), M_9- Native soil + FYM+ VC + Rice husk (3:1:0.5:0.5). The ADT (R) 45 was used as a test variety. The presoaked seeds weighed as per treatment and it was soaked in to water over night before sowing and two day after incubation the partially sprouted seedling tray where placed in wet nursery. The native soil where acquired in the field which is sieved 2 mm mesh. Tray soil medium was filled as per the proportion of the treatment. The seedling growth attributes were taken 14, 18 and 22 days after sowing (DAS).

RESULTS AND DISCUSSIONS

Seedling Height

In rice tray nursery seedling height was significantly influenced by the seed rate and nutrient media. The taller seedling (17.3, 18.4 and 21.8 cm at 14, 18 and 22 DAS, respectively) was recorded under 40 g seed tray^{-1}. It was followed by 60 g seed tray^{-1}. The shorter seedling height (12.5, 14.9 and 18.0 cm at 14, 18 and 22 DAS, respectively.) was recorded under 100 g seed tray^{1}. This might be due to lesser seeding density and nutritive media in nursery thus ultimately results increasing photosynthetic activity of seedlings resulting in more translocation of photosynthates to the roots and shoots which enhanced their elongation. The finding are in corroboration with previous findings of Vasudevan *et al.* (2014). Among the media, taller seedling (16.8, 21.4 and 23.4 cm at 14, 18 and 22 DAS, respectively) was recorded with native soil + Coir pith + VC at ratio 3:1:1 and it was followed by native soil + FYM+ VC + Rice husk at ratio 3:1:0.5:0.5. The shorter seedling (13.5, 14.1 and 18.1 cm at 14, 18 and 22 DAS, respectively) was registered with native soil tray. The interaction was significant among the combination of 40 g seed tray^{-1} with Native soil + Coir pith + VC (3:1:1) registered taller seedling (19.4, 24.0 and 25.3 cm at 14, 18 and 22 DAS, respectively) and this was followed by the 40 g seed tray^{-1} with Native soil + FYM+ VC + Rice husk at 3:1:0.5:0.5 ratio. The shorter seedling (11.4, 12.9 and 16.4 cm at 14, 18 and 22 DAS, respectively) was noticed under 100 g seed tray^{-1} with Native soil. This could be due to less competition during early stages between seedlings in tray and supply of nutrients to the growing seedling from the media. Seniz *et al.* (2011) and Abirami *et al.* (2010) also indicated relatively similar trends when seedlings were subjected to different growing media.

Seedling Root Length

The rice seedling root length of seedling had significantly influenced by the seed rate and different nutrient media. The lengthier root (6.7**,** 7.4 and 8.6 cm at 14, 18 and 22 DAS, respectively) was recorded under 40 g seed tray^{-1} it was followed by 60 g seed tray^{-1}. The shorter root length (4.6, 5.7 and 6.4 cm at 14, 18 and 22 DAS, respectively) was recorded

under 100 g seed tray^{-1}. Among the media, the lengthier seedling root length (6.7, 8.0 and 9.4 cm at 14, 18 and 22 DAS, respectively) was registered under Native soil + Coir pith + VC (3:1:1) followed by Native soil + FYM + VC (3:1:1). The shorter root length (4.7, 5.3 and 6.1 cm at 14, 18 and 22 DAS, respectively) was recorded under Native soil tray. Among the interaction effect, combination of 40 g seed tray^{-1} with Native soil + Coir pith + VC (3:1:1) (8.2, 9.0 and 10.8 cm at 14, 18 and 22 DAS, respectively) was to be the best treatment combination in terms of lengthier root which was followed by 40 g seed tray^{-1} with Native soil + FYM + VC (3:1:1). The shorter root length (3.8, 4.9 and 5.3 cm at 14, 18 and 22 DAS, respectively) was recorded under 100 g seed tray^{-1} with Native soil. It can be established that such variation was due to the roots interconnectivity as well as high level of competition for nutrient, water, sunlight and aeration experienced by the establishing seedlings in the conventional practice. The variance in seedling root length is due to the favorable growing environment received by seeding density and tray media Bashar *et al.* (2014) indicated that growing environmental condition plays a significant role on vigor and quality of rice seedling.

SPAD Reading

Seed rate and growing media used for tray media was also influenced in seedling SPAD values. The higher SPAD value (20.0, 24.6 and 21.8 at 14, 18 and 22 DAS, respectively) recorded in 40 g seed tray^{-1} and it was followed by 60 g seed tray^{-1}. The lower SPAD value (14.8, 18.2 and 18.1 at 14, 18 and 22 DAS, respectively) was recorded under 100 g seed tray^{-1}. Among the growing tray media the maximum SPAD value (22.6, 27.8 and 23.6 at 14, 18 and 22 DAS, respectively) was noticed under Native soil + Coir pith + VC (3:1:1) and followed by Native soil + FYM+ VC + Rice husk (3:1:0.5:0.5). The lower SPAD value (14, 17.2 and 18.2 at 14, 18 and 22 DAS, respectively) was recorded in Native soil tray. The interaction between the seed rate and nursery growing media was also significantly influenced the SPAD readings. The higher SPAD value (29.2, 36.0 and 25.9 at 14, 18 and 22 DAS, respectively) was found in 40 g seed tray^{-1} with Native soil + Coir pith + VC (3:1:1) and this was followed by 40 g seed tray^{-1} with Native soil + FYM + VC (3:1:1). The lower SPAD value (12.9, 15.8 and 16.9 at 14, 18 and 22 DAS, respectively) recorded under 100 g seed tray^{-1} with Native soil. This might be due to the combined effect of lesser seed rate and growing seedlings on fertile media have a synergistic effect on chlorophyll content. This was in accordance with the earlier finding of of Adhikari *et al*. (2013); Subedi (2013) and Sarwa *et al.* (2011).

Seedling DMP

The results clearly showed that the seedling dry matter production was significantly influenced by the seed rate and nursery media. The maximum DMP (0.0394, 0.0438 and 0.0508 g seedling^{-1} at 14, 18 and 22 DAS, respectively) was found under 40 g seed tray^{-1} and it was followed by 60 g seed tray^{-1}. The minimum DMP (0.0315, 0.0351 and 0.0396 g seedling^{-1} at 14, 18 and 22 DAS respectively) registered under 100 g seed tray^{-1}. Among the growing media the maximum DMP (0.0435, 0.0485 and 0.0554 g seedling^{-1} at 14, 18 and 22 DAS, respectively) recorded in Native soil + Coir pith + VC at 3:1:1 media. This was followed by media Native soil + FYM+ VC + Rice husk (3:1:0.5:0.5 mg seedling^{-1}). The lower seedling DMP (0.0268, 0.0299 and 0.0339 g at 14, 18 and 22 DAS, respectively) recorded under native soil tray. The interaction of the seed rate and nursery growing media was also significantly influenced in seedling DMP. The maximum seedling DMP (0.0480, 0.0533 and 0.0619 g at 14, 18 and 22 DAS, respectively) was found under 40 g seed tray^{-1} with Native soil + Coir pith + VC (3:1:1). It was followed by 40 g seed tray^{-1} with Native soil + FYM + VC (3:1:1). The minimum seedling DMP (0.0237, 0.0267 and 0.0289 at 14, 18 and 22 DAS, respectively) was noticed under the combination of 100 g seed tray^{-1} with Native soil. The seedling DMP may be attributed to the ideal seed rate, characteristic

of the growth media and high content of organic acids (such as humic and fulvic acids, etc.). The dry weight of seedlings mainly depends on the concentration of nutrients in the media this was supported by earlier findings of Mamun *et al.,* (2013).

CONCLUSIONS

Production of good quality of seedlings is prerequisite for machine transplanting. The results revealed that the seed rate and different growing media significantly influenced the growth characters of tray rice seedlings than conventional method. Among the 80 g seed rate tray^{-1} was found be optimum for producing sturdy rice seedlings than the lower seed rate of 40 g and higher seed rate of 100 g tray^{-1}. Among the nursery media, Native soil + Coir pith + VC at 3:1:1 ratio was found to the ideal combination in growing rice seedlings in the tray nursery. Hence a moderate seed rate of 80 g tray^{-1} sowing in the media contain native soil + Coir pith + VC at 3:1:1 ratio can be recommend in production of sturdy rice seedling for machine transplanting.

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APPENDICES

Table 1: Influence of different Seed Rate and Nutrient Media Tray^{-1} on Seedling Height (cm) at 14, 18 and 22 DAS

Seedling Height (cm) 14 DAS						Seedling Height (cm) 18 DAS					Seedling Height (cm) 22 DAS				
Treatments	**S_1**	**S_2**	**S_3**	**S_4**	**Mean**	**S_1**	**S_2**	**S_3**	**S_4**	**Mean**	**S_1**	**S_2**	**S_3**	**S_4**	**Mean**
M_1	11.4	12.8	14.0	15.9	**13.5**	12.9	13.2	14.6	15.6	**14.1**	16.4	17.6	18.7	19.7	**18.1**
M_2	12.3	13.7	15.2	17.4	**14.6**	13.9	14.7	15.7	16.8	**15.3**	17.0	18.9	19.6	20.9	**19.1**
M_3	12.8	14.8	15.7	17.6	**15.2**	14.6	15.5	16.5	18.2	**16.2**	17.5	20.1	21.2	21.2	**20.0**
M_4	11.8	14.0	14.0	16.4	**14.0**	13.1	14.5	14.7	15.8	**14.5**	18.2	20.3	20.9	21.6	**20.2**
M_5	10.9	12.5	13.4	15.0	**13.0**	12.5	13.3	13.8	15.1	**13.7**	16.3	18.6	19.7	19.9	**18.6**
M_6	13.1	15.3	16.4	17.4	**15.5**	16.7	18.0	19.2	20.5	**18.6**	19.4	22.3	22.6	24.4	**22.2**
M_7	14.2	16.5	17.1	19.4	**16.8**	17.9	21.1	22.8	24.0	**21.4**	20.9	23.4	24.1	25.3	**23.4**
M_8	12.5	14.8	14.9	17.1	**14.8**	15.5	16.5	17.5	18.7	**17.1**	18.6	20.3	21.4	21.5	**20.5**
M_9	13.5	15.1	16.3	19.6	**16.1**	16.8	18.8	20.0	21.3	**19.2**	17.9	21.9	22.2	22.2	**21.0**
Mean	**12.5**	**14.4**	**15.2**	**17.3**		**14.9**	**16.2**	**17.2**	**18.4**		**18.0**	**20.4**	**21.2**	**21.8**	
Source	**S**	**M**	**SxM**	**MxS**		**S**	**M**	**SxM**	**MxS**		**S**	**M**	**SxM**	**MxS**	
CD (p=0.05)	0.39	0.37	0.79	0.73		0.47	0.54	1.13	1.09		0.42	0.36	0.79	0.71	

S_1 – 100 g seed per tray S_2 – 80 g seed per tray S_3 – 60 g seed per tray S_4 – 40 g seed per tray	M_1–Native soil M_2 -Native soil + FYM (4:1) M_3 -Native soil + VC (4:1) M_4 -Native soil + Coir pith (4:1) M_5 -Native soil + Sand (4:1) M_6 -Native soil + FYM + VC (3:1:1) M_7 -Native soil + Coir pith + VC (3:1:1) M_8 -Native soil + FYM + Rice husk (3:1:1) M_9- Native soil + FYM+ VC + Rice husk (3:1:0.5:0.5)

Table 2: Influence of different Seed Rate and Nutrient Media Tray^{-1} on Seedling Root length (cm) at 14, 18 and 22 DAS

Root Length (cm) 14 DAS						Root Length (cm) 18 DAS					Root Length (cm) 22 DAS				
Treatments	**S1**	**S2**	**S3**	**S4**	**Mean**	**S1**	**S2**	**S3**	**S4**	**Mean**	**S1**	**S2**	**S3**	**S4**	**Mean**
M1	3.8	4.2	5.1	5.5	**4.7**	4.9	5.0	5.4	5.9	**5.3**	5.3	5.7	6.4	6.9	**6.1**
M2	4.5	5.0	6.1	6.6	**5.5**	5.1	5.7	6.1	6.6	**5.9**	6.0	6.6	7.3	7.9	**6.9**
M3	4.7	5.2	6.4	6.8	**5.8**	5.6	6.2	6.7	7.3	**6.4**	6.1	6.7	7.5	8.1	**7.1**
M4	4.3	4.8	5.9	6.3	**5.3**	5.3	5.9	6.3	6.9	**6.1**	5.7	6.3	7.0	7.6	**6.7**
M5	4.1	4.5	5.5	5.9	**5.0**	5.0	5.5	5.9	6.4	**5.7**	5.3	5.8	6.5	7.0	**6.2**
M6	5.1	5.7	7.0	7.5	**6.3**	6.6	7.4	8.0	8.7	**7.7**	7.6	8.4	9.3	10.3	**8.9**
M7	5.4	6.0	7.4	8.2	**6.7**	6.7	7.6	8.7	9.0	**8.0**	8.0	8.9	10.0	10.8	**9.4**
M8	4.6	5.1	6.2	6.7	**5.7**	5.7	6.3	6.8	7.4	**6.5**	6.5	7.2	8.0	8.7	**7.6**
M9	5.0	5.5	6.7	7.2	**6.1**	6.3	7.0	7.5	8.2	**7.3**	7.3	8.2	9.0	9.7	**8.5**
Mean	**4.6**	**5.1**	**6.2**	**6.7**		**5.7**	**6.3**	**6.8**	**7.4**		**6.4**	**7.1**	**7.9**	**8.6**	
Source	**S**	**M**	**SxM**	**MxS**		**S**	**M**	**SxM**	**MxS**		**S**	**M**	**SxM**	**MxS**	
CD (p=0.05)	0.16	0.12	0.28	0.24		0.14	0.12	0.26	0.24		0.20	0.17	0.37	0.33	

S_1 – 100 g seed per tray S_2 – 80 g seed per tray S_3 – 60 g seed per tray S_4 – 40 g seed per tray	M_1–Native soil M_2 -Native soil + FYM (4:1) M_3 -Native soil + VC (4:1) M_4 -Native soil + Coir pith (4:1) M_5 -Native soil + Sand (4:1) M_6 -Native soil + FYM + VC (3:1:1) M_7 -Native soil + Coir pith + VC (3:1:1) M_8 -Native soil + FYM + Rice husk (3:1:1) M_9- Native soil + FYM+ VC + Rice husk (3:1:0.5:0.5)

Table 3: Influence of different Seed Rate and Nutrient Media Tray^{-1} on Seedling SPAD Value at 14, 18 and 22 DAS

SPAD N at 14 DAS						SPAD N 18 at DAS					SPAD N 22 at DAS				
Treatments	**S1**	**S2**	**S3**	**S4**	**Mean**	**S1**	**S2**	**S3**	**S4**	**Mean**	**S1**	**S2**	**S3**	**S4**	**Mean**
M1	12.9	13.2	14.5	15.5	**14.0**	15.8	16.2	17.9	19.1	**17.2**	16.9	17.6	18.7	19.7	**18.2**
M2	13.9	14.7	15.6	16.7	**15.2**	17.0	18.1	19.2	20.6	**18.7**	17.3	18.9	19.8	20.9	**19.2**
M3	14.5	15.4	16.4	17.6	**16.0**	17.9	19.0	20.2	21.6	**19.7**	17.5	20.1	21.2	21.2	**20.0**
M4	13.0	14.5	14.7	15.7	**14.5**	16.0	17.8	18.1	19.3	**17.8**	18.2	20.3	21.1	21.6	**20.3**
M5	12.5	13.2	14.1	15.0	**13.7**	15.3	16.3	17.3	18.5	**16.9**	16.3	18.6	20.0	19.9	**18.7**
M6	16.6	17.9	19.1	23.9	**19.4**	20.4	22.1	23.5	29.4	**23.8**	17.9	21.8	22.2	22.2	**21.0**
M7	17.8	21.0	22.3	29.2	**22.6**	21.9	25.8	27.5	36.0	**27.8**	20.7	23.0	24.8	25.9	**23.6**
M8	15.5	16.4	17.5	20.4	**17.4**	19.0	20.2	21.5	25.1	**21.5**	18.4	20.3	21.3	21.5	**20.4**
M9	16.7	18.7	19.9	26.2	**20.4**	20.5	23.0	24.5	32.3	**25.1**	20.0	22.1	22.6	23.4	**22.0**
Mean	**14.8**	**16.1**	**17.1**	**20.0**		**18.2**	**19.8**	**21.1**	**24.6**		**18.1**	**20.3**	**21.3**	**21.8**	
Source	**S**	**M**	**SxM**	**MxS**		**S**	**M**	**SxM**	**MxS**		**S**	**M**	**SxM**	**MxS**	
CD (p=0.05)	0.75	0.69	1.50	1.38		0.94	0.80	1.77	1.60		0.56	0.49	1.08	0.99	

S_1 – 100 g seed per tray S_2 – 80 g seed per tray S_3 – 60 g seed per tray S_4 – 40 g seed per tray	M_1–Native soil M_2 -Native soil + FYM (4:1) M_3 -Native soil + VC (4:1) M_4 -Native soil + Coir pith (4:1) M_5 -Native soil + Sand (4:1) M_6 -Native soil + FYM + VC (3:1:1) M_7 -Native soil + Coir pith + VC (3:1:1) M_8 -Native soil + FYM + Rice husk (3:1:1) M_9- Native soil + FYM+ VC + Rice husk (3:1:0.5:0.5)

Table 4: Influence of different Seed Rate and Nutrient Media Tray^{-1} on Seedling DMP (g) Value at 14, 18 and 22 DAS

Seedling DMP (g) at 14 DAS						Seedling DMP (g) at 18 DAS					Seedling DMP (g) at 22 DAS				
Treatments	**S1**	**S2**	**S3**	**S4**	**Mean**	**S1**	**S2**	**S3**	**S4**	**Mean**	**S1**	**S2**	**S3**	**S4**	**Mean**
M1	0.0237	0.0261	0.0280	0.0296	**0.0268**	0.0267	0.0290	0.0311	0.0329	**0.0299**	0.0298	0.0327	0.0351	0.0382	**0.0339**
M2	0.0312	0.0343	0.0368	0.0390	**0.0353**	0.0347	0.0381	0.0409	0.0433	**0.0393**	0.0392	0.0431	0.0475	0.0503	**0.0450**
M3	0.0327	0.0360	0.0386	0.0409	**0.0370**	0.0363	0.0400	0.0429	0.0454	**0.0411**	0.0411	0.0452	0.0497	0.0527	**0.0472**
M4	0.0300	0.0330	0.0354	0.0375	**0.0340**	0.0333	0.0367	0.0393	0.0417	**0.0378**	0.0377	0.0414	0.0456	0.0483	**0.0433**
M5	0.0258	0.0284	0.0304	0.0323	**0.0292**	0.0287	0.0315	0.0338	0.0358	**0.0325**	0.0324	0.0356	0.0392	0.0416	**0.0372**
M6	0.0342	0.0376	0.0404	0.0428	**0.0387**	0.0380	0.0418	0.0448	0.0472	**0.0430**	0.0429	0.0472	0.0520	0.0551	**0.0493**
M7	0.0384	0.0422	0.0453	0.0480	**0.0435**	0.0433	0.0469	0.0503	0.0533	**0.0485**	0.0482	0.0530	0.0584	0.0619	**0.0554**
M8	0.0312	0.0343	0.0375	0.0390	**0.0355**	0.0347	0.0381	0.0409	0.0433	**0.0393**	0.0392	0.0431	0.0475	0.0503	**0.0450**
M9	0.0366	0.0396	0.0432	0.0458	**0.0413**	0.0407	0.0447	0.0480	0.0508	**0.0461**	0.0460	0.0505	0.0557	0.0590	**0.0528**
Mean	**0.0315**	**0.0346**	**0.0373**	**0.0394**		**0.0351**	**0.0385**	**0.0413**	**0.0438**		**0.0396**	**0.0436**	**0.0479**	**0.0508**	
Source	**S**	**M**	**SxM**	**MxS**		**S**	**M**	**SxM**	**MxS**		**S**	**M**	**SxM**	**MxS**	
CD (p=0.05)	0.0008	0.0006	0.0013	0.0011		0.0008	0.0006	0.0013	0.0011		0.0010	0.0008	0.0018	0.0015	

S_1 – 100 g seed per tray S_2 – 80 g seed per tray S_3 – 60 g seed per tray S_4 – 40 g seed per tray	M_1–Native soil M_2 -Native soil + FYM (4:1) M_3 -Native soil + VC (4:1) M_4 -Native soil + Coir pith (4:1) M_5 -Native soil + Sand (4:1) M_6 -Native soil + FYM + VC (3:1:1) M_7 -Native soil + Coir pith + VC (3:1:1) M_8 -Native soil + FYM + Rice husk (3:1:1) M_9- Native soil + FYM+ VC + Rice husk (3:1:0.5:0.5)